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ABSTRACT

An autosegmental analysis of Kagate tone is presented. The focus is on tonal instability, which occurs as the result of a compensatory lengthening process. To account for facts of tonal stability, previously hypothesized, and tonal instability, it is proposed that the location of tone within the overall geometry is subject to parametric variation, or it may otherwise not be elegantly accounted for if tone must be directly associated with the skeleton. It is concluded that tone in Kagate is associated with the laryngeal node, as part of the feature geometry. The report contains an autosegmental analysis of Kagate and comparisons with tonal patterns in Zahao and Nupe. Zahao also has a compensatory lengthening process that results in the loss of tonal information, and the Zahao facts are seen as further substantiating the instability analysis. Nupe tone spreading is discussed as further evidence that in some languages, tone can be subordinate to the laryngeal node. A 28-item list of references is included. (MSE)

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TONAL INSTABILITY *

Tone as Part of the Feature Geometry

Stephen P. Walker

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1 INTRODUCTION

In this paper I present an analysis of Kagate tone,[1] within an autosegmental framework (Goldsmith 1976). The principal focus is the phenomenon of **tonal instability**, which occurs as the result of a compensatory lengthening process:

(1) /ᴴto-ᴴaŋ/ -> [tooŋ] 'cooked.meal-also'

/ᴸkǫ-ᴴaŋ/ -> [kǫǫŋ] 'door-also'

In (1) the vowel of the suffix loses its melodic quality, and takes instead the melody of the previous vowel. Crucial to the topic of this paper, the tone of the suffix is simultaneously lost.

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* For their helpful comments and suggestions, I would like to thank Albert Bickford and especially Juliette Levin. Special thanks also go to Steve Marlett. Thanks go to Betty Brown, Hyun-Sook Kang, John Kingston, Heechul Lee, Randy Valentine, Bob Wright and those who attended a class presentation at the University of Texas. Needless to say, I alone am responsible for remaining shortcomings. Comments are welcome and can be sent c/o Department of Linguistics, Calhoun Hall 501, Austin, TX 78712.

[1] Kagate is a Tibeto-Burman language spoken in Nepal by approximately 1000 speakers. The speakers prefer the name Syuuba to Kagate. The dialect under consideration is spoken in the Phedi village, in the Saipu-Sabra Panchayat Ramechhap District (Höhlig and Hari 1976).

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Tonal instability clearly contrasts with Goldsmith 1976, where the term "tonal stability" was coined. That analysis, in combination with work substantiating the existence of a timing tier, e.g., the CV-skeleton (Clements and Keyser 1983),[2] led to the framework where tone is directly associated to the skeleton. Thus the V-slot can delete or desyllabify, or the melodic features can delink from the skeleton, and yet the tonal information is left intact.

To account for both the tonal stability and the tonal instability facts, I propose that the location of tone within the overall geometry is subject to parametric variation. Otherwise, if tone must be directly associated to the skeleton, then we cannot elegantly account for the tonal instability facts.

Therefore I conclude that tone in Kagate is associated to the **Laryngeal node**, as part of the **Feature Geometry** (Clements 1985). This is a natural assumption to make, since Kagate is among the languages where tone register is closely related to the laryngeal feature [+Spread Glottis] (henceforth [+SG]).[3]

The organization of the paper is as follows. An autosegmental analysis of Kagate is found in §2. The preliminaries are dealt with in §2.1, and the notion of **tonal realization**, as opposed to tonal association, is introduced. The basic idea is that a tone contour may be realized over a larger domain than the one with which the underlying tone is actually associated.

Also in §2.1 is a discussion of the feature system for Kagate tone contours, as well as arguments for associating a single tone to the left edge of the realization domain. Next a tone deletion rule is proposed, to derive certain Kagate tonal patterns. Finally, I give a default rule to formally state the relationship between breathy voicing and tone.

The tonal instability facts are discussed in §2.2. Here I give a compensatory lengthening rule and a feature geometry model, to account for the instability of tone. As mentioned previously, if tone in Kagate is

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[2] Whether the timing tier is represented as an X-skeleton, composed of mere timing units (Levin 1985), one encoding syllabicity, the CV-skeleton (Clements and Keyser 1983), or as a moraic tier (Hayes 1989) is irrelevant to the issue of instability. However, as Albert Bickford points out, the compensatory lengthening process itself substantiates the need for some tier composed of timing or weight units.

[3] Whether the feature [SG] is monovalent or bivalent is irrelevant here, but I treat it as a bivalent feature for clarity of presentation.

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subordinate to the Laryngeal node, then anything affecting the Laryngeal node or Root node may also affect the tone.

Kagate is not without tonal stability effects, however. These arise from a tone spreading rule, which applies before the compensatory lengthening rule (§2.3). Apparent tonal stability, therefore, can sometimes result in languages where tone is a laryngeal feature.

Zahao[4] (Osburne 1979) also has a compensatory lengthening process which results in the loss of tonal information (§3). Yip's 1980 proposal is discussed, including an explanation of why a feature geometry model succeeds where a "bottle-brush" model does not. The Zahao facts correlate closely with those of Kagate, further substantiating the instability analysis.

Finally, in §4 I discuss Nupe[5] tone spreading. The process is blocked by voiceless consonants, a possibility predicted if tone can be associated with the Laryngeal node. This, then, is further evidence that tone can, in some languages, be subordinate to the Laryngeal node.

2 KAGATE

2.1 An autosegmental analysis

2.1.1 Introduction. Before delving into the tonal instability data, and before establishing and determining the place of tone within the feature geometry, first I will present a basic description of Kagate tone, and try to determine the feature system and underlying representation necessary to account for the data.

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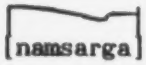
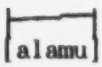
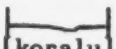
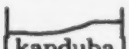
[4] Zahao is also in the Tibeto-Burman family, but is a Chin language spoken in north-western Burma.

[5] Nupe is a Kwa language that is spoken in Nigeria.

There are four phonetic tones, as shown in the following forms:[6]

(2)

4:	 namsarga	'sky'	ce	'shut!'
3:	 alamu	'banana'	ce	'tongue'
2:	 koralu	'shepherd'	ṭi	'tool'
1:	 kanduba	'how?'	ṭi	'ask!'

As shown above, breathy voicing ([+SG]) on the initial vowel co-occurs with the lower tonal register. The register affects the pitch of the entire tonal domain (both edges of the contour), and not just the initial syllable, where the feature [+SG] is associated.

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[6] Tone is represented graphically to the left of each form. Forms without tones are "atonal." Here I depart from Höhlig and Hari 1976 in numbering their 1, 2, 3, and 4-tones as 4, 3, 1, 2, respectively. In my system, then, the left edge of the 4-tone is the highest and that of the 1-tone is the lowest.

Vowels represented as /V̤/ are breathy voiced. Retroflex stops are /ṭ,ḍ/. I use diagonal bars, //, to enclose forms that are nearer to the underlying representations and square brackets, [], to enclose forms that are nearer to the phonetic representation.

I use the following abbreviations:

H	=	[+High] (tone)
L	=	[-High] (tone)
Lar	=	Laryngeal node
N	=	Syllable nucleus
Rt	=	Root node
S-Lar	=	Supralaryngeal node
Ton	=	Tonal node
[±CG]	=	[±Constricted Glottis]
[±H]	=	[±High] (tone)
[±SG]	=	[±Spread Glottis]
[±Up]	=	[±Upper] (tone register)
[±Vce]	=	[±Voice]

The domain for tonal realization[7] is minimally a single syllable (3), intermediately the morpheme (4), and maximally the entire word (5):[8]

(3) /^{3}syar-^{4}aŋ/ 'youngster also'

(4) /^{1}meme-^{4}so/ 'grandfathers'

(5) /^{4}laŋ-la/ 'to the ox'

The usual case is that the tone of the stem is realized over the entire word, including suffixes. Höhlig and Hari note (p. 46): "Most of the suffixes are atonal," as seem in (5), above. However, there are five suffixes which have underlying tone (p. 47):

(6) /-^{4}so/ (honorific)

/-^{4}kya/ (plural)

/-^{4}kyok/ (perfect participle on verb)

/-^{4}aŋ/ 'also'

/-^{2}kǫ̈y/ (2nd/3rd sing. subject; present tense)

The last suffix, /-^{2}kǫ̈y/, is exceptional in having a breathy-voiced vowel. The normal case is that the feature [+SG] can only be associated to a segment in the word-initial syllable. This accounts for the (otherwise) regular absence of both breathy voiced vowels and aspirated voiceless stops in non-initial syllables (see Höhlig and Hari, p. 25).[9]

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[7] But, I argue in §2.1.2, these are not the domains for tonal association. Tone associates only with the left-edge of the domain of tonal realization.

[8] The underlying representation in (4) includes some predictable information, since either [+SG] or [±Up] is underlying. This is resolved in §2.1.2.

[9] Also, note that another subject agreement suffix is irregular. The first person singular subject suffix /-gẽ/ (pp. 17,20) has the only occurrence of a nasalized vowel in a non-initial syllable.

It would be interesting to know if these might be clitics, but there is no syntactic information and just a few sentences of text. These are not pronouns, since the word order is SOV and there are the subject pronouns /mǫ̈/ "she" and /k^{h}u̱ŋ/ "he/she."

2.1.2 Tone features, tonal realization domain, and tone deletion. The feature system that I will assume is that of Yip 1980: a feature [±Upper] to distinguish register and [±High] to distinguish height levels within the register.

Given the register and height of the left-edge of the tone contour, the rest of the contour is entirely predictable. This, combined with the (exclusive) relevance of the initial syllable to the tonal register, suggests that a single tone on the initial syllable accounts for the entire contour. Under this analysis, we have the following tones:

(7)
4-tone:	[+Up], H
3-tone:	[+Up], L
2-tone:	[-Up], H
1-tone:	[-Up], L

However, Kagate speakers might possibly distinguish between 2 and 1-tones by the relative height of the highest point in the contour.[10] If this is the case, then we should reverse the values for [H/L] for these tones, since the 1-tone actually rises higher than the 2-tone.

In support of my analysis, however, are the suffixes in (6). Four of the five suffixes have 4-tones: [+Up], H. This suggests that this is the default tone (the completely unspecified tone). Note also that the fifth suffix has a 2-tone: [-Up], H. If [Up], the tone register feature, is underlyingly unspecified, but arises through default rule (8b), then the tone for all five of the suffixes is the default tone: H.

This analysis requires the following default rules, the second of which formalizes the relationship between breathy voicing and tonal register:

(8) **Default Rules:**

a. [ ] -> [+H]
b. [+SG] -> [-Up]
c. [ ] -> [+Up]

All vowels are, then, unspecified for [±Up] in underlying representations. It would have been possible, of course, to state the reverse of the first default rule ([-Up] -> [+SG]). This is undesirable, however, because of

[10] Juliette Levin pointed out this possibility.

the suffixes mentioned above, and because if the feature [SG] is underlying it allows us to unify the constraints on this feature.[11] This analysis also falls in line with the generalization that consonants types (i.e., their laryngeal features) affect tone, but not the reverse.

To indicate the move toward a radically unspecified representation (Archangeli 1988), henceforth the material in angled brackets will not contain a number for tone. Instead of numbers there will be H or L. The tone contour is then derivable from whether the initial vowel is clear or breathy-voiced. The four tones are, then:

(9) 4-tone: H, V
3-tone: L, V
2-tone: H, V̬
1-tone: L, V̬

Although H-tones are underspecified underlyingly, I will continue to mark them, so as to distinguish between tonal and atonal morphemes.

A consequence of radically underspecifying the underlying tone, as in (7), is that complex contour tones must accounted for with a single tone (or no tone at all). The phonetic interpretation rules bear the burden, then, of determining the actual tone contour over the time continuum (Yip 1987).[12] These rules will take a single tone as their input, and produce level and contour tones over a string of syllables, until the next tonal syllable or the end of the word is encountered.

In other words, if there are tonal suffixes, then they will each have a single tone, and it will mark the left edge of its own tonal realization domain as well as the right edge of the previous domain. So, although tone is realized over a certain domain, tone is associated only with the beginning of that domain. As we will see, this greatly simplifies the tone

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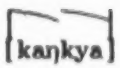
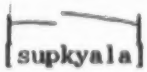
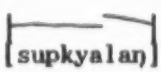
[11] For example, [+SG] can only be associated to segments in the word-initial syllable. Also, if the initial vowel is clear-voiced ([-SG]), then the voicing of obstruents in that syllable is (predictably) [-Vce]: /^{H}ke/ 'bear!' vs. ^{L}[ke̬] 'break!' and ^{L}[gu̬] 'corner.' This curious fact suggests that [±SG] is an underlying feature of vowels, not [±Up], since [SG] is more closely related to [Vce] than is [Up].

[12] Yip cites Pierrehumbert, J. and M. Beckman 1986 (Japanese Tone Structure. Unpublished ms., AT&T Bell Labs and Ohio State University), which I have not seen.

spread processes in this language, since it only involves the spread or loss of a single tone.[13]

(10) a. /^{H}kaŋ-^{H}kya/ ->  'nipples of udder'

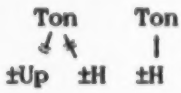
b. /^{L}sup-^{H}kya-la/ ->  'in the holes'

c. /^{L}sup-^{H}kya-la-^{H}aŋ/ ->  'in the holes also'

In (10c) the tone of /-^{H}kya/ disappears. Assume, for the moment, that the rule (or constraint) that deletes this tone can also apply to contour tones on bi- or trisyllabic morphemes. If we represent such contour tones as sequences of level tones, associated to the left and right edges (Yip 1987), then clearly whatever accounts for the loss of the tonal contour would have to delete both tones (HL or LH). This is an unnecessary complication if we assume that contour tones are the result of a single underlying tone.

For example, for (10c) we can specify this rule in a relatively uncomplicated format (were it to involve the deletion of two tones, then it would have been hopelessly complicated):[14]

(11) **Central-Tone Deletion (CTD):**



This rule states that if there are two adjacent Tonal nodes, the first of which is unspecified for [±Up], then delink the first tone from its Tonal node (only H-tones will occur in this environment). The rule in (11) might be motivated by the fact that we don't find sequences of three tones in the language.[15] It relies on the underspecification of [±Up] for all vowels

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[13] The second example (10b) is not actually given in Höhlig and Hari, but is based on their description: "(Atonal suffixes) have no pitch of their own. The realization of their pitch is dictated by the contour of the stem morphemes" and "A tonal suffix has a distinctive pitch of its own -- the realization of its pitch does not fall under the contour of the stem" (p. 46).

[14] This rule cannot be formulated in terms of the Tonal node delinking from the Laryngeal node. Such a rule would be blocked by intervening consonants, since the Laryngeal nodes would not be adjacent.

[15] Juliette Levin pointed out this possibility.

except the initial vowel, as well as that the initial vowel is specified for [±Up] before Central-Tone Deletion can apply. Therefore the default rule (8b) must apply before CTD, so that the initial tone is not deleted; and the default rule (8c) must not apply to non-initial syllables before CTD applies, so that the relevant tones are deleted. Default rule (8a), like (8b), must apply before CTD applies.[16]

2.2 Tonal instability

The delinking and compensatory lengthening process previously mentioned are shown in (12):

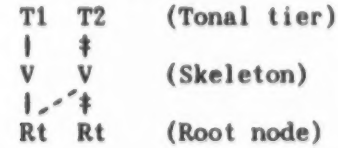
(12) a. /^{H}to-^{H}aŋ/ -> 'cooked.meal-also'

b. /^{L}kǫ-^{H}aŋ/ -> 'door-also'

The segmental melody of the suffixal vowel does not surface. The tone of the suffix, an upper register falling tone, does not surface either. But, crucially, the timing slot remains, and the melody of the previous vowel spreads. If this were not the case, then we would analyze this as a case of deletion of the melody, the timing slot and also the tone. However, since the skeletal slot remains, this shows that delinking, and not deletion, is taking place.

Under the traditional autosegmental representations of tone, where tone associates to the skeleton directly, we can formulate the compensatory lengthening and tone loss rule as in (13):

(13) **V-Cluster Simplification:** (preliminary version)[17]



(Tonal tier)
(Skeleton)
(Root node)

However, the multiple cases of delinking give us ample reason to wonder if this is the correct rule. That is, unless there is independent evidence

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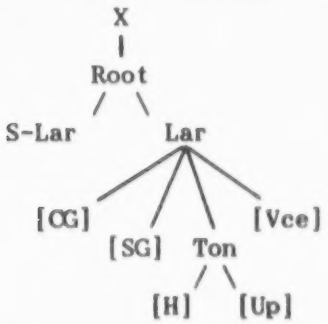
[16] It is interesting that CTD cannot be formulated in a framework where the Tonal node is directly associated to the skeleton, since the V-slots would not be adjacent. This might tempt one to invoke the OCP (Yip 1988), which, I plan to argue in a future version of this paper, will lead to incorrect results.

[17] Rather than delinking or spreading the highest possible node, the root node, the vowel assimilation process could be seen as delinking or spreading just the Place or Dorsal node.

of tonal delinking in this environment, then we prefer to view the disappearance of the vowel melody and the tone as a single process.

The proper representation for V-Cluster Simplification must include tone as part of the segmental melody. Otherwise we have to delete the tone and the melody independently but simultaneously, which is a problem. This new representation is where breathy voicing comes into play. If both tone and [+SG] are daughters of the Laryngeal node, then perhaps that will help explain why breathy voicing co-occurs with the lower tonal register. It will also explain tonal instability, since delinking of any of the association lines connecting it to the skeleton will result in tone loss.

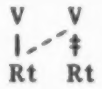
(14) **Tone as a Laryngeal Feature:**



My proposal is that at least some languages represent the Tonal node as subordinate to the Laryngeal node, as opposed to its being directly associated to the skeleton. For such languages **tonal instability** is a possibility.

Within the understanding that (14) brings, we can revise the V-Cluster Simplification rule as follows:

(15) **V-Cluster Simplification (VS): (final version)**



V-Cluster Simplification applies lexically, only in derived environments (obeying the Strict Cycle Condition), and is structure preserving. For example, it cannot create long vowels in non-initial syllables, due to the

following well-formedness condition.[18]

(16) If: V V
\ /
N
|
Then: Word[σ

This well-formedness condition states that if there is a branching syllable nucleus, then that syllable must be word-initial.

2.3 Apparent tonal stability

There are cases of apparent tonal stability in Kagate, which would seem to invalidate the proposal that tone is a laryngeal feature. This, I argue, is due to a tone spreading process.

The tonal instability occurs only when the suffix is vowel-initial (/-^{H}aŋ/) and the stem is both vowel-final and monosyllabic. If the stem ends in a consonant or is not monosyllabic, then the tone of the suffix remains, as in (17):

(17) a. /^{H}laŋ-^{H}aŋ/ -> [laŋaŋ] 'ox also'

b. /^{H}kara-^{H}aŋ/ -> [karaŋ] 'shawl also'

The consonant-final stem, (17a), presents no problem, since V-Cluster Simplification does not take place. The disyllabic stem (17b), however, seems to exhibit tonal stability. I analyze this as an environment where tone spreading occurs:

(18) **Tone Spread (TS):** (preliminary version)

Lar Lar
\ |
Ton Ton

The tone spreads leftward to a vowel unspecified for tone. Because TS is a lexical rule, Structure Preservation (Kiparsky 1982) ensures that tone cannot spread to consonants.

---

[18] Here I follow the format of Itô 1986. Incidentally, the V-Cluster Simplification rule in (15) may not need to be stipulated as such, but may well be the result of syllabification parameters and well-formedness conditions. What is important is that the process involves delinking the root node from the second vowel slot, whatever the cause.

To account for the above data, Tone Spread (TS) and V-Cluster Simplification (VS) must be ordered as follows:

(19) <TS,VS> (counterbleeding with respect to (17b))

The result is in (17b) that the tone from /-^{H}aŋ/ spreads to the previous vowel, which (crucially) is not specified for tone. Simplification applies, deleting the suffixal vowel /a/. The tone remains behind, but not because of normal tonal stability, but because of the previous rule of tone spread.

Tone Spread is independently required in the grammar, given the existence of the following forms (p. 46):[19]

(20) /ma-^{H}si/ -> [masi] 'did not die'

/ma-^{L}pi/ -> [mapi] 'did not take off'

/ma-^{H}l̥i/ -> [ma̤li] 'did not remain'

/ma-^{L}t̥i/ -> [ma̤ti] 'did not ask'

The tone is underlyingly associated, I propose, to the initial vowel of the stem. The feature [+SG] must shift leftward (perhaps it is assigned under stress, which is initial) to meet a well-formedness condition. After that occurs, the default rule (8b) specifies the initial syllable as [-Up], if applicable.

The above data do seem to present a problem for Tone Spread, however. Since /ma-/ can (presumably) prefix to any verb, then a stem-initial obstruent that is specified for [±Vce] ought to block the application of Tone Spread. Höhlig and Hari mention no such possibility.

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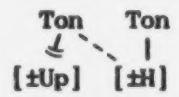
[19] Other than /ma-/, there are no prefixes in the language.

Note that V-Cluster Simplification (15) would be expected to apply if /ma-/ attached to a vowel-initial verb stem. The description does not mention that this occurs. There are only a handful of vowel-initial verbs, and the only case of a medial onsetless syllable is [ka̤en] "cucumber," which fluctuates with [ka̤yen]. So the onset is obligatory, and perhaps the few exceptions meet this well-formedness condition by having an underlying empty C-slot as onset. The other alternative is to reformulate (15).

Aspiration is completely unpredictable in all stem-initial stops (whether or not the following vowel is breathy-voiced is irrelevant). Therefore they should block the application of TS, as written.[20]

The solution is to rewrite the rule as applying to adjacent Tonal nodes. Thus TS will not be blocked by intervening consonants, since they have no such node. But if the rule spreads [+H] tones to the left-adjacent Tonal node, then the rule must be prevented from spreading tones onto initial syllables. This can be achieved by ensuring that the left Tonal node is unspecified for [±Up].

(21) **Tone Spread (TS):** (final version)



This rule says that if there are two adjacent Tonal nodes, the left one unspecified for [±Up], then spread the value for [±H] (i.e., [+H]) of the right Tonal node leftward. This solves the problem of intervening consonants not blocking blocking TS, since they have no Tonal nodes.

Notice the similarity of this rule to Central Tone Deletion (11). The similarity goes beyond mere appearances, since TS, like CTD, requires that default rules (8a) and (8b) apply before it (so that the rule can apply and so that the initial tone is not spread to, respectively); and that default rule (8b) must not apply to non-initial syllables before TS applies (so that the relevant Tonal nodes are spread to). In other words, TS and CTD have the same crucial orderings with the default rules (8a,b).

It is now possible to eliminate CTD, in favor of TS. If TS applies to a Tonal node that is already specified for [±H], then the spreading of the new value results in automatic delinking of the old. If, on the other hand, TS applies to a Tonal node that is unspecified for [±H], then the left Tonal node marks the beginning of a tonal realization domain. The reason for the deletion of the central tone is now explained, given the existence of Tone Spread.

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[20] The most transparent way out of this problem is to appeal to Left-to-Right Association Conventions and Lexical Phonology to try to account for the supposed tone spreading. However, as Steve Marlett has helped me to see, that would require the Association Conventions to apply at the end of the stratum (i.e., after affixation). This would require a modification of Pulleyblank 1986, which asserts that the Conventions apply wherever they may.

Furthermore, there are certain data that I plan to prove (in a future version of this work) cannot be accounted for unless tone is underlying associated (i.e., pre-associated).

With that apparatus in place, we will now go through some novel tone patterns, to see if it indeed predicts the correct pattern. One pattern not yet discussed occurs if a tonal suffix follows an atonal one (p. 48):

(22) /^{L}la-la-^{H}aŋ/ -> [lalaŋ] 'soul-in-also'

/^{H}la-la-^{H}aŋ/ -> [laḷaŋ] 'height-on-also'

Rather than receiving its tone from the preceding morpheme, the atonal suffix /-la/ receives its tone from the following suffix, /-^{H}aŋ/. This result is predicted by TS, since it ought to apply here.

The following forms have bisyllabic stems, with two tonal suffixes (p. 49):

(23) a. /^{H}aji-^{H}so-^{H}aŋ/ -> [ajisoŋ] 'elder.sister-honorific-also'

b. /^{L}ani-^{H}so-^{H}aŋ/ -> [anisoŋ] 'aunt-honorific-also'

c. /^{H}nọmo-^{H}so-^{H}aŋ/ -> [nọmosoŋ] 'younger.sister-honorific-also'

d. /^{L}mẹme-^{H}so-^{H}aŋ/ -> [mẹmesoŋ] 'grandfather-honorific-also'

In each example in (23a-d) there is a toneless vowel, the second vowel of the stem. Tone Spread appears like it should have applied here, but it did not. However, if /-^{H}so/ is a Level I affix, and if TS applies on the second stratum, then this is no problem.

In (23a), for example, the result of Level I morphology is [[^{H}aji]^{H}so]. At some point the default rules apply, supplying the initial syllable's vowel with the feature [+H, +Up] (Structure Preservation prevents the other vowels from being specified [+Up] at Level I) and non-initial vowels with [+H]. V-Cluster Simplification cannot apply, since its environment is not met. So the form is unchanged after Level I phonology, with the exception of the feature filling default rules, syllabification, etc.

The result of Level II morphology is [[^{H}aji^{H}so]^{H}aŋ]. Default rule (8a) supplies the feature [+H] for the vowel of the suffix. Structure Preservation prevents this vowel from being specified for [±Up], since only the initial vowel can take this feature. Tone Spread applies, spreading [+H] from /-^{H}aŋ/ to the Tonal node of /-^{H}so/. This results in the original [+H] on /-^{H}so/ being automatically delinked (since a single Tonal node cannot bear two specifications of [±H]). Now V-Cluster Simplification applies, spreading the Root node of /o/ to /a/. This also results in automatic delinking, of the Root node of /a/. The end of the cycle syllabification

attempts to syllabify the entire word, but the well-formedness condition in (16) prevents the second V-slot from being syllabified, and it is Stray Erased (Itô 1986). And so the apparently problematic example is correctly predicted.

Now I will repeat the problematic data in (10c), along with similar examples (p. 49):

(24) /^{H}pu-^{H}kya-la-^{H}aŋ/ -> [pukyalaŋ] 'feather-pl.-in-also'

/^{L}sup-^{H}kya-la-^{H}aŋ/ -> [supkyalaŋ] 'hole-pl.-in-also'

/^{H}pu̟-^{H}kya-la-^{H}aŋ/ -> [pu̟kyalaŋ] 'son-pl.-to-also'

/^{L}du̟-^{H}kya-la-^{H}aŋ/ -> [du̟kyalaŋ] 'grain-pl.-in-also'

This data is still problematic, given CTD and TS as a single rule. Even if the combined TS rule applied iteratively, it would still not work for the above forms. The tone on /-^{H}aŋ/ would spread to /-la/, and then (incorrectly) spread to /-^{H}kya/. Also, iterative application of TS would derive the wrong results for the forms in (23a-d). Cyclic application would not help either, since the environment for TS is not met until /-^{H}aŋ/ is affixed.

Despite the explanatory force of a simple Tone Spread rule, it appears that two separate rules may be necessary.[21] In such a model, we need to specify that CTD applies before VS, or VS might bleed CTD:

(25) ⟨CTD,VS⟩ (counterbleeding with respect to (24))

On the other hand, CTD and TS are unordered. Say, then, that CTD applies first. The two non-initial Tonal nodes result in the application of Central-Tone Deletion. Now /-kya/ has no tone. Next, Tone Spread applies, moving the H-tone of /-^{H}aŋ/ to the atonal /-la/. Then V-Cluster Simplification applies, delinking the vowel melody of /-^{H}aŋ/. The result is that the stem tone stays put, unchanged, and the H-tone of /-^{H}aŋ/ spreads to the suffix /-la/, the correct result.

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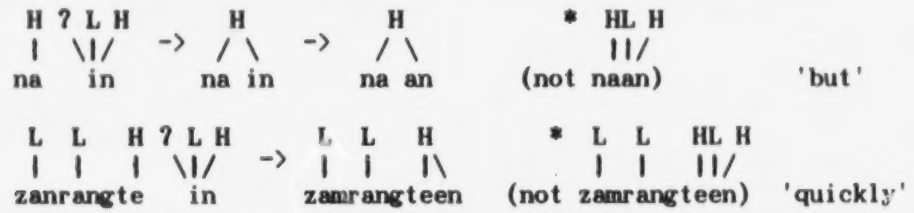
[21] An alternative would be to posit an additional rule to handle just this case.

3 TONAL INSTABILITY IN ZAHAO

The tonal instability facts are similar in Zahao (Osburne 1979, Yip 1980 and 1982). In the following forms (26) the melody of the stem vowel spreads to the following V-slot, resulting in the automatic delinking of the suffixal vowel melody (or delinking and compensatory spreading). Here, as in Kagate, the tone of the suffix deletes with its vowel melody:[22]

(26)



This data was cited in Yip 1980 and 1982, where she says:

> Firstly, what is actually deleted is the tone and the glottal stop, not the vowel. Both these are laryngeal phenomena, and as such this may in fact be an argument in FAVOR of an independent laryngeal tier on which both tone and glottalization are represented... The deletion is then of the information on this laryngeal tier, while the segmental tier remains untouched. Subsequently the two adjacent vowels assimilate.
>
> Secondly, it is not clear from Osburne's article how general a phenomenon this elision is, but in her thesis... she states specifically that this adverbial particle is the ONLY morpheme that elides in normal speech. It is therefore a morphological rather than a phonological rule, and as such would not necessarily be expected to obey the predictions of the stability hypothesis [emphasis hers].

I'd like to comment on these two points. With regard to the first, my conclusions match Yip's: the interaction between tone and laryngeal features argues for the possibility of an "independent laryngeal tier."[23] Within feature geometry, however, tone would be subordinate to the Laryngeal node, which would be part of the entire melody, as in (14).

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[22] The Osburne 1979 article makes no mention of the status of /ʔ/, the glottal stop. Yip 1982 analyzes this process to include elision of /ʔ/, but I suspect that is a vowel feature ([+CG]) that sometimes surfaces as an onset.

[23] Yip 1987 mentions (in passing) "the issue of whether the Laryngeal node, some sub-node we might call Tonal are (where tone is associated)." It appears, then, that I am certainly not the first to propose a Tonal node daughter to the Laryngeal node.

Yip claims, however, that the deletion of the laryngeal information and the vowel assimilation are distinct processes. This claim is a necessary consequence of an autosegmental model where the laryngeal tier and the vowel place features tier are distinctly associated to the skeleton, as in the "bottle-brush" model. Such a model has the same problem with tonal instability as the standard "feature geometry" model. In either case, tone and place features are independently associated to the skeleton, and so the tonal instability facts require two separate processes.

Such an analysis seems suspect, however, since in Kagate there is the identical clustering of properties: vowel assimilation, loss of tonal information, and some involvement of laryngeal features. As shown in §2.2 for Kagate, this clustering of properties is no accident with the representation in (14), where tone is subordinate to the Laryngeal node, and the single rule in (15), spreading the root node from one vowel to the next V-slot.

Turning to Yip's morphological analysis, note that /-^{H}aŋ/ is the only suffix in Kagate that loses its tone. This suffix, however, happens to be the only vowel-initial suffix in Kagate. This is why the tonal instability effects only occur with /-^{H}aŋ/, because the language does not allow true vowel clusters. A morphological analysis is unwarranted, then, to explain the tonal instability.[24]

4 TONE SPREADING IN NUPE: EVIDENCE THAT TONE IS A LARYNGEAL FEATURE

Now we turn to Nupe. Hyman 1975 refers to the following Nupe data (27) as showing how "different consonant types frequently interact with natural tonal assimilations." (p. 228).[25]

(27)	/pá/	'peel'	[èpá]	'is peeling'
	/bá/	'be sour'	[èbǎ]	'is sour'
	/wá/	'want'	[èwǎ]	'is wanting'

(28) /gbìgbì tí/ 'an owl hooted'
/gbìgbì ètí/ 'an owl is hooting'

Here the low tone of the progressive tense marker /è-/ is spreading to the stem, to form a rising tone, but only if the intervening consonant is voiced. Thus [-Vce], a laryngeal feature, blocks the spreading of tone.

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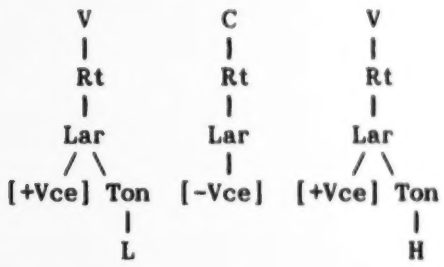
[24] There is not enough data in the Osburne 1979 article to determine if there is a similar explanation for the exceptionality of the /-ʔin/ suffix in Zahao.

[25] The data in (28) is from Kenstowicz & Kisseberth (1979, p. 268), who cite George 1970.

First let's look at a representation where the Tonal node is a daughter of the Laryngeal node, along with voicing, etc. Here, in (29), we see that the [-Vce] feature does not prevent adjacency of the two Tonal nodes, and thus will not necessarily block tone spreading. The intervening consonant does not have a Tonal node, and so the Tonal nodes of the vowels are adjacent:

(29)



Perhaps, then, the rule specifies spreading of the Laryngeal node. One way to ensure this would be if languages without a register distinction, such as Nupe, do not have Tonal nodes. If that is true, then the Nupe tone spreading rule would involve two (necessarily adjacent) Laryngeal nodes. The [-Vce] consonant, with its own Laryngeal node, would block the adjacency of the two Laryngeal nodes, and thus block the application of tone spreading. Voiced consonants, on the other hand, would have to be unspecified for laryngeal features, or perhaps share a Laryngeal node with a neighboring vowel.[26]

The main point is that to adequately account for the Nupe facts, tone must be subordinate to the Laryngeal node, and not directly associated to the timing tier.[27]

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[26] Another possibility, pointed out by Juliette Levin, is that voiceless consonants are specified for tone (perhaps by regressive spreading from the following vowel). The specification of tone on the consonant might prevent the forward tone spreading, if the rule specifies spread to vowels alone. However, this analysis seems to me an ad-hoc method for blocking tone spread. Is there any other evidence that in Nupe voiceless consonants can and should be specified for tone?

Another alternative is that tone in Nupe is subordinate to the [±Vce] feature. In this case, a [-Vce] consonant will prevent the two [+Vce] features of the vowels from being adjacent. Again, we must state that [+Vce] consonants are unspecified for that feature (at this point in the derivation), or that they share the [+Vce] feature with a vowel. The problem with this analysis is that vowels need not be specified for [±Vce] underlyingly. In any event, I hope to have shown that tone is subordinate to the Laryngeal node in Nupe.

[27] Schuh 1978 also mentions Bade, Bolanci, Zulu, and Ngizim as languages in which laryngeal features block tone spreading.

5 SUMMARY AND CONCLUSION

The question of where tone associates (or is underlyingly associated) is subject to parametric variation. In some languages, tone is associated with the skeleton. There is no possibility of tonal instability effects, although stability effects may well occur.

In other languages, however, tone is associated to the Laryngeal node, whether underlyingly or by convention. The strongest claim is that in all "laryngeal tone" languages the specified tones are underlyingly associated, rather than by convention. This may often or always arise through tonogenesis (Matisoff 1973). Some tone bearing units may be unassociated with any tone. Intervening consonants may block the spreading of tone. In such languages, there may be cases of tonal instability, and sometimes apparent stability.

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